UK GRAIN TESTING NETWORK

MEMBER HANDBOOK

Version 2.1 – September 2026

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Significant revisions for this edition

Section	Location	Change
2.8	Page 5	Addition of changes to tests covered at harvest 2026.
4.4	Page 8	Addition of changes to tests covered at harvest 2026.
7.2.1	Page 14	Addition of source of assigned values for new tests added at Harvest 2026.
7.5.1.1	Page 16	Inclusion of uncleaned samples.
7.6.5	Page 17	Inclusion of additional cases where administrator may request amendment of data before the round closes.
8.3.2.11	Page 21	Wording changed.
Appendix Ib	Page 27	NEW – List of recommended methods for the new tests added at Harvest 2026
Appendix II	Page 32	Source of accepted values: Rewritten due to addition of new tests added at Harvest 2026
Appendix III	Page 34	Various changes to details of the committee members and addition of Social Media links

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1. Introduction

1.1 The UK Grain Testing Network (UKGTN or Network) is a membership-based group for people involved in the analysis of grain, with the shared objective of achieving the most accurate results from their instruments and reducing disagreement between analytical results across the grain industry. The Network provides a cost-effective way to help achieve this.

1.2 The UK Grain Testing Network is administered by The UK Grain Testing Network Limited, a not-for-profit company formed in 2024. UKGTN Limited charges an annual fee to UKGTN members to cover the costs of providing ring checks, harvest monitoring, and the fees charged by instrument suppliers for the work involved in standardising instruments and maintaining and improving calibrations.

2. History

2.1 The Network began in 1994 as an NIR user group formed by representatives of two grain traders, Allied Grain Ltd. and Glencore Grain (UK), and a maltster, Carlsberg–Tetley Ltd., who between them owned 12 Foss Infratec instruments.

2.2 Originally called the *UK Infratec Network*, it focused only on Barley and Wheat calibrations, which the three companies and the instrument supplier collaborated on to monitor and improve. The original subscription, which did not include ring checks, was £2000 per instrument.

2.3 By the late 1990s, the Network had launched its monthly ring check, and in 2002 it changed its name to the *UK NIR Grain Network* to emphasise independence from any individual supplier. Around this time, a 'ring check only' membership option was introduced, allowing users of any instrument type to participate. Membership grew rapidly, and the scheme expanded to include Rapeseed and later, Oats and Beans. Administration of the ring checks, membership renewals, and accounts were subcontracted to third-party providers.

2.4 In 2016 the Network launched its PT Portal to simplify ring check data submission and report production, and new report types further increased the value of the data available to users.

2.5 In 2017 the Network changed its name again, becoming the *UK Grain Testing Network*, enabling it to expand beyond NIR testing. While Falling Number had been included in the Wheat ring checks for many years, the Network's remit widened to include Mycotoxin and Erucic Acid analysis.

2.6 In 2024, after 30 years as a committee-led user group, the Network formed a limited company, with many committee members becoming directors. At around the same time a PSY scheme was launched, and the Network became involved with image-based crop analysis.

2.7 Following the change in legal status, UKGTN Ltd. employed staff and established its own premises in Lincoln in late 2025. All work previously subcontracted to third parties was brought in-house in January 2026. This decision was made to take full control of the Network activities and costings rather than outsourcing the preparation and distribution of samples, report production and harvest monitoring.

2.8 In March 2026 it was agreed that the ring check scheme be expanded to include several additional tests such as admixture, screenings and visual analysis. It was agreed to send some of the samples out without cleaning them first to better reflect real world conditions when measuring these new analytes.

3. Aims and objectives

The UKGTN is operated for the benefit of its members with the following aims and objectives.

3.1 To standardise all full member instruments to a common reference point just prior to harvest with the aim of minimising differences between instruments using the same calibrations.

3.2 To work with, and provide data to, instrument suppliers to enable them to update calibrations annually, incorporating new varieties and climate variation to enhance robustness and accuracy.

3.3 To monitor the performance of the calibrations and, if required, update all relevant instruments with bias and skew adjustments (via the suppliers).

3.4 To collaborate with instrument suppliers on behalf of the members if any investigation is required due to deterioration in calibration or instrument performance.

3.5 To provide ring check samples on a regular basis to allow members to compare their instrument performance with that of others and to reference analysis.

3.6 To supply a service that will help to reduce disagreements in analytical results throughout the grain industry.

3.7 To encourage good laboratory practices by members by using common samples, sharing data in a cost-effective manner and providing advice and training.

3.8 To have a system whereby membership indicates to others that certain standards for grain analysis are being met.

4. Membership

4.1 There are 320 members in the Network (as of September 2026) in locations over a large part of the UK, ranging from Cornwall to Easter Ross, East Anglia to Merseyside and Northern Ireland. There are a small number of overseas members, mostly in the Republic of Ireland. The membership has grown each year since the Network started but is still relatively small compared to some Networks in Europe and other parts of the world. The companies involved include plant breeders, grain merchants, farmers' co-operatives, grain exporters, flour millers, maltsters, brewers, distillers, oilseed crushers, instrument manufacturers/suppliers and research organisations.

There are two types of membership:

4.2 **Full Membership**: Involves having an NIR instrument which can participate fully in the Network. These instruments are currently limited to:

- Foss Infratec 1241, Infratec Nova and Infratec TM
- Foss DA1650
- Perten Inframatic 9500
- Infracont X-Grain and S-Grain

4.2.1 The Network **does not** currently support calibrations for any other instrument types or instrumentation from any other manufacturers. The Network works with other instrument manufacturers from time to time to help assess their equipment and calibrations and may decide to add equipment and calibrations to the list of those supported for 'Full Membership' following review of the data by the committee.

4.2.2 Full Membership is on a 'per instrument' basis.

4.2.3 Full Members receive up to 20 Standardisation samples for Erucic Acid in March each year, and 8 for Barley and Wheat, and 10 for Rape, Oats and Beans at the beginning of May, depending on which commodities they have signed up for.

4.2.4 Individual instruments are standardised before harvest by scanning these samples and comparing the scans with the scans from the sub-master instruments at UKGTN Ltd. and Sharnbrook Grain.

4.2.5 Most members (271 as of September 2026) have full membership and access to all the benefits of standardisation, calibration monitoring and ring check provision that the Network provides.

4.3 **Ring Check Only**: Participation in the ring check is included in full membership but also offered to those that do not have the appropriate instruments for full membership, or don't wish to have full membership for their instrument. Any requirements for standardisation, calibration updates or harvest assessments on ring check only instruments must be made directly with the instrument manufacturer or supplier. Ring Check Only participation typically accounts for around 10 – 15% of total membership.

4.4 The Network supports the following commodities for Full members and Ring Check Only participants:

	Full Member	Ring Check Only	Rounds per year	Samples per round
Barley – Moisture, DM Nitrogen, Specific Weight, Admixture, Broken Grain, Skinned Grain, Split Grain, % Retained on 2.5 mm sieve, % Screenings through a 2.25 mm sieve, Germination Capacity.	✓ Moisture, Nitrogen, Specific Weight	✓	11	4
Wheat – Moisture, DM Protein (N x 5.70), Specific Weight, Falling Number, Admixture, Screenings through a 2.0 mm sieve.	✓ Moisture, Protein, Specific Weight	✓	11	4
Rapeseed – Moisture, Oil @9% Moisture, Admixture, Burnt Seed, Chitted Seed, Immature Seed, Rancid Seed.	✓ Moisture, Oil	✓	6	3
Rapeseed – Erucic Acid	✓ DA 1650 Only	✓	3	4
Oats - Moisture, DM Protein (N x 6.25) and Specific Weight, Admixture, Screenings through a 2.0 mm sieve.	✓ Moisture, Protein, Specific Weight	✓	6	3
Beans – Moisture, AR Protein (N x 6.25), Admixture, Bruchid Damage, Stained.	✓ Moisture, Protein, Specific Weight	✓	4	3
Mycotoxin – (DON, OTA, ZEA)		✓	3	3
PSY – (by invitation only) – Predicted Spirit Yield		✓	4	4

4.5 On joining the Network, each instrument shall be identified by a unique Network Number which is known only to the member, their instrument supplier and UKGTN. The members will be issued a Membership Certificate showing their company and instrument details, Network Number and the commodities and analytes which they have signed up for.

4.6 The Membership Certificate demonstrates only that the instrument is signed up to the UKGTN for Standardisation and Calibration (full members only) and Ring Checks. It does not demonstrate that the instrument is standardised, nor that it has the latest calibrations installed or that it is submitting acceptable data to the UKGTN Ring Check.

4.7 Lists of participating companies and sites will be given on the UKGTN website at **https://www.ukgrain.org/membership.** This is to clarify who has Network membership and hence should be working to a known set of standards. Network Numbers are not included on the membership lists.

4.8 Our systems can hold one Primary contact for each instrument who will receive all messages. In addition, we can hold one Secondary contact who we will contact if there is no response from the Primary contact. The PT Portal can have an unlimited number of user accounts who will be copied in on any emails sent via the PT portal such as emails notifying of sample dispatch or report availability. PT Portal accounts are deleted after 12 months of inactivity.

4.9 It is imperative that the Network Technical Administrator is kept informed of any changes in members' contact details. This is particularly true for changes to primary contact names and e-mail addresses.

4.10 Where it is important for your business that several individuals are copied in on emails from us, we would encourage you to set up mail forwarding rules within your organisation to ensure that this happens. We do not have a system to ensure that additional contacts are included. Emails from UKGTN always come from the **@ukgrain.org** domain so you can use this to set up mail forwarding rules.

5. Network Calendar

5.1 The Network runs on an annual cycle beginning on June 1st each year and ending on May 31st the following year. During this 'Harvest Year' the Network operates 11 ring check rounds plus an annual standardisation exercise and a post standardisation / pre-harvest 'Quick Check' to assess the effect of Standardisation before harvest.

5.2 Please note: As we cannot produce ring check samples until we receive *new harvest* bulk samples, the first few rounds are often delayed, and so we name them R01, R02 etc. rather than including the name of the month to avoid potential confusion if sending them out in a different month.

5.3 The table below shows which commodities are sent out in each round. Those highlighted in Yellow should be kept for use in the 'quick check' exercise. Those highlighted in Red should be kept for a full 12 months in case of future instrument issues.

Typical Month	Round Name	Barley	Wheat	Rape	Oats	Beans	Erucic	Toxin
June	Quick Check							
July	R01	✓	✓	✓			✓	✓
August	R02	✓	✓	✓	✓		✓	
September	R03	✓	✓	✓	✓	✓		
October	R04	✓	✓		✓			✓
November	R05	✓	✓	✓		✓	✓	
December	R06	✓	✓		✓	✓		
January	R07	✓	✓	✓				✓
February	R08	✓	✓		✓			
March	R09	✓	✓			✓		
	Erucic Standardisation						✓	
April	R10	✓	✓		✓			
	Erucic Quick Check							
May	R11	✓	✓	✓				
	Standardisation	✓	✓	✓	✓	✓		

5.4 The table below shows the approximate timings of various Network tasks.

	Tasks
June	Prepare Workbook Daily Dumas and NIR samples, Spike R01 Toxin, Scan Collection, Calibration Download, set up Workbook, run Quick Check, publish Standardisation Reference Data.
July	Quick Check reports, Committee Quick Check review, source Bulk and Harvest Samples, run daily Workbooks, prepare R01 samples, weekly Workbook Committee review.
August	Source Bulk and Harvest samples, run daily Workbook, run R01, prepare R02 samples, weekly Workbook Committee review.
September	Run R02, send out R03 samples, spike R04 Toxin, run daily Workbook, weekly Workbook Committee review.
October	Publish 'Outlier Removed' Workbooks, apply post-harvest Bias corrections, report R03, run R04.
November	Run R05, UKGTN Harvest Review Meeting.
December	Run R06, spike R07 Toxin
January	Run R07, Price Review with subcontractors, equipment servicing begins.
February	Run R08, Committee set Subscription and Rebate levels, start packing Standardisation samples, produce Erucic Standardisation Instructions, send Membership Renewal forms.
March	Run R09, UKGTN Harvest Planning Meeting, pack Standardisation samples, send renewal reminders, renewal closes.
April	Confirm Membership list for next season, run R10, produce Standardisation Instructions, prepare Membership Invoices, produce Membership Certificates, Erucic Standardisation Scanning, Erucic Calibration Download.
May	Run R11, pre-Harvest Webinars, send Standardisation Instructions, communications check, send Standardisation Samples, scan Standardisation Samples, equipment servicing ends, send out membership invoices, Erucic Quick Check.

5.5 Subscription renewal notices must be returned to UKGTN before the renewal close date to ensure that appropriate numbers of samples can be prepared and distributed in time for standardisation in May.

5.6 Subscriptions are paid annually (per crop year) by invoice and cover 1st June to 31st May. Rebates for samples and reference data supplied to UKGTN accrue throughout the crop year and are deducted from the following year's subscription.

5.7 Invoices must be paid within 30 days of issue. The Network reserves the right to suspend membership if payment is not received within 30 days. Suspension may involve: Ceasing to supply Ring Check samples, removing your ability to access the PT Portal or reports generated by it, ceasing to supply new, or removing existing, calibration bias updates and asking suppliers to remove network calibrations from your instrument. The Network also holds the right to request payment in advance for serial late payers.

5.8 The Network can only function if member companies supply the various samples that are required during the year. In a typical year, we require up to 250 Bulk samples of between 10 kg and 120 kg to use for Standardisation and Ring Checks and around 900 x 1 kg harvest monitoring samples. Members supplying suitable samples receive a credit against subscriptions for the following year. The credit is reviewed annually by the Network Committee and will not be paid if the samples supplied are underweight and cannot be used.

5.9 Please note that on becoming a Full Member of the Network you agree to the Technical Administrator having remote access to your equipment via the relevant supplier's communication software. This is to allow the Administrator to monitor such things as calibration and standardisation status and is not access for looking at any other data. Full confidentiality is assured and can be discussed (if you have any concerns) by telephoning the Technical Administrator on 07738 260550. The Technical Administrator, along with the rest of the Committee, has signed a confidentiality agreement.

6. Roles and Responsibilities

6.1 Operating the UK Grain Testing Network involves a wide range of tasks carried out by different organisations, groups and individuals. This section outlines the responsibilities of each.

6.2 The parties involved are:

6.2.1 **UK Grain Testing Network Limited:** A not-for-profit company established to administer the Network. It employs and contracts staff to carry out work on behalf of the Steering Committee.

6.2.2 **Network Members:** Over 300 members within the grain sector, representing 150+ companies and 250+ sites. Membership of UKGTN is on a per-instrument basis.

6.2.3 **Network Steering Committee:** A group of 12–15 members representing different industries and regions within the grain sector. The committee sets Network requirements and direction and instructs the Technical Administrator accordingly.

6.2.4 **UKGTN Technical Administrator:** Contracted by UKGTN Ltd. to oversee Network operations on behalf of the Steering Committee.

6.2.5 **UKGTN Proficiency Schemes Manager:** Employed by UKGTN Ltd. to manage the Ring Check Scheme and other activities required by the Steering Committee.

6.2.6 **UKGTN Laboratory Manager:** Employed by UKGTN Ltd. to manage the Lincoln laboratory site and other activities required by the Steering Committee.

6.2.7 **Reference Laboratories:** Contracted organisations responsible for carrying out reference testing to support effective calibration monitoring.

6.2.8 **Instrument Suppliers:** Manufacturers and UK suppliers of grain testing equipment. They work with UKGTN to develop, maintain and adjust calibrations and are invited to committee meetings as appropriate.

6.3 **The Network, its Steering Committee, and UKGTN Ltd. cannot be held liable for any financial or commercial losses arising from its services**.

6.4 The Network is **not** responsible for the precision or accuracy of calibrations; master calibrations are owned and maintained by the instrument suppliers.

6.5 **Network Member Responsibilities:**

6.5.1 Review their instrument's Ring Check performance and take corrective or preventative action in the event of unsatisfactory z-scores or biases.

6.5.2 Scan standardisation samples following supplied protocols.

6.5.3 Store standardisation and quick-check samples appropriately; replacements may not be available and may incur a cost if requested.

6.5.4 Ensure their instrument is connected to the internet, ideally continuously, but at a minimum during communication checks, scan uploads, and calibration downloads.

6.5.5 Monitor any non-Network calibrations on commodities (e.g. rye, maize, peas) or analytes (e.g. alcohol yield, colour, ergosterol). Users of NIR models not eligible for full membership must liaise directly with their instrument supplier for standardisation and bias monitoring.

6.5.6 Understand that all analyses, including NIR, have inherent analytical error, which may increase due to the presence of mouldy, pre-germinated or immature grains, excessive foreign seed, unusual varieties, growing conditions, moisture levels etc.

Oilseed rape calibrations are particularly affected by the presence of high erucic acid type seeds.

6.5.7 Check they are using up-to-date calibrations via supplier websites, Ring Check reports, or communication with the Network.

6.5.8 Notify instrument suppliers and the Technical Administrator immediately if calibration issues are suspected and assist in gathering evidence to demonstrate the issue.

6.5.9 Run daily IQC control samples and participate in additional ring check schemes as appropriate. The TASCC Requirements for Testing Facilities of Combinable Crops will provide guidance.

6.5.10 Understand that participation in UKGTN Ring Check rounds is voluntary but strongly recommended.

6.5.11 Liaise with UKGTN to resolve any courier issues preventing timely delivery of samples, including notifying UKGTN promptly if samples have not been delivered by the expected dates.

6.5.12 Check samples immediately on receipt and alert UKGTN if replacement samples are required for any reason so that they can be sent in time to meet the closing date of that round.

6.5.13 Test the samples and report the results AS SOON AS POSSIBLE so that if any problems arise there is time to address them before the round closes.

6.6 Steering Committee Responsibilities:

6.6.1 Determine Network operations and appoint contractors for essential tasks.

6.6.2 Maintain a balanced composition representing sectors, regions, and company sizes.

6.6.3 Maintain confidentiality.

6.6.4 Assess the network NIR calibrations on the sub-master instruments.

6.6.5 Assess performance of any non-NIR analyses included in the Network scope. (e.g. Specific Weight, Falling Number, Mycotoxins).

6.6.6 Review calibration performance over harvest by using Workbooks and decide on bias adjustments.

6.6.7 Liaise with Instrument Suppliers to improve calibration precision and stay up to date on the latest developments in grain testing technologies.

6.7 Technical Administrator responsibilities:

6.7.1 Oversee all Network activities to achieve the aims of the Steering Committee

6.7.2 Liaise with the Proficiency Schemes Manager, Laboratory Manager, Instrument Suppliers, Reference Laboratories and Third Parties.

6.7.3 Organise and minute annual Harvest Planning and Review meetings, weekly Harvest Workbook meetings and other meetings and sub-groups as required by the committee.

6.7.4 Represent UKGTN at industry events etc. as required by the Committee.

6.7.5 Maintain and update the UKGTN website.

6.7.6 Communicate harvest monitoring and calibration bias decisions to the instrument suppliers.

6.7.7 Maintain confidentiality.

6.7.8 Provide harvest data to instrument suppliers to support calibration improvements.

6.7.9 Oversee network accounts, issuing and paying invoices as required.

6.8 Proficiency Schemes Manager responsibilities:

6.8.1 Deliver a Ring Check which meets the Steering Committee requirements for range of commodities, number of samples per round, number of rounds, timing etc.

6.8.2 Source sufficient Bulk Samples to meet the committee requirements.

6.8.3 Oversee the Standardisation process and liaise with Instrument Suppliers to provide instructions and reminders to members.
6.8.4 Oversee the distribution of Ring Check and Standardisation samples.
6.8.5 Operate the PT Portal on behalf of the Network.
6.8.6 Maintain membership and contact databases.
6.8.7 Maintain confidentiality.
6.8.8 Prepare reports for Members, Instrument Suppliers, the Steering Committee and the Technical Administrator.
6.8.9 Produce daily 'Barley Workbooks' throughout harvest.
6.8.10 Liaise with instrument suppliers to confirm calibration requirements.
6.8.11 Communicate updates, information, instructions, and reminders to members.

6.9 Laboratory Manager responsibilities:
6.9.1 Follow the methodology specified by the Steering Committee when testing samples.
6.9.2 Follow good laboratory practice to ensure consistent, high quality reference results.
6.9.3 Carry out reference testing in a timely manner to allow results to be used in the calculations of Ring Check and Standardisation assigned values.
6.9.4 Maintain confidentiality.
6.9.5 Oversee the cleaning, blending and packing of Ring Check and Standardisation samples.
6.9.6 Oversee Harvest Monitoring testing and data compilation.
6.9.7 Oversee Ring Check and Standardisation testing through the sub-master instruments.

6.10 Instrument Suppliers responsibilities:
6.10.1 Maintain accurate scan and calibration status records for each networked instrument.
6.10.2 Attend Steering Committee meetings (in person or remote) as requested.
6.10.3 Implement calibration bias adjustments as instructed by the Technical Administrator.
6.10.4 Maintain an ongoing programme of calibration updates and improvements on Network calibrations.
6.10.5 Maintain confidentiality.
6.10.6 Carry out an annual standardisation procedure to align the individual network instruments as closely as possible with their sub-master instrument.

7. Ring Checks

7.1 Since October 2025, the UK Grain Testing Network Limited has taken ownership of all the UKGTN work which used to be outsourced.

7.1.1 The UKGTN Laboratory has been audited by KIWA to the TASCC Standard for Testing and Appendix 15 (Proficiency Testing) of that standard.

7.1.2 Monthly ring check samples are sent out to enable members to confirm the performance of their instruments throughout the year.

7.1.3 The Network is careful not to only select perfect samples that predict well by NIR.

7.1.4 The ring checks may highlight problems with the crop, e.g. contamination, pre-germination, unusual varieties etc.

7.1.5 The Network does not issue instructions concerning how to present the ring check sample to the NIR. For example, some members may carefully pick out any foreign seed. Other members may analyse the sample three times and take the mean to give a more exact value etc. The protocol used is left entirely to the individual member.

7.2 Reference Analyses

7.2.1 Members' results for Moisture, Protein / Nitrogen, Oil, Erucic Acid, Toxins, PSY and Specific Weight are judged against reference results from the Network reference laboratories, commercial laboratories and members' expert labs using methods shown in Appendix Ia. For other tests the members' results are judged against the robust mean of all data supplied by the members using the tests in Appendix Ib.

7.2.2 Any member is welcome to apply to supply reference analyses provided the methodologies used are appropriate. If you are interested in supplying reference data, please contact the Technical Administrator.

7.2.3 Member expert labs must be able to submit consistent, accurate and precise reference data on time and for all samples.

7.2.4 Members will be reimbursed for consistent and accurate reference analysis, in the form of a rebate from their next subscription fee.

7.2.5 Reference analysis and reference lab performance will be monitored at the Spring and Autumn committee meetings.

7.3 Network Reference Laboratories

7.3.1 The Network has two reference laboratories:

7.3.1.1 **The UKGTN Laboratory** is the barley, wheat, oat and bean reference laboratory. It is accredited to the TASCC Standard for Testing including Appendix 15 (Proficiency Testing) under TASCC number YY3795. It supplies the Network with analytical data as well as running the monthly ring check scheme.

7.3.1.2 **Sharnbrook Grain** acts as the reference laboratory for Rapeseed and they are accredited to the TASCC Standard for Testing under TASCC number XX252.

7.4 Ring Checks Explained

7.4.1 It is good laboratory practice, and essential in many codes of practice and quality standards (e.g. TASCC), to take part in appropriate ring check schemes. These provide a means to compare results between laboratories performing similar analyses and, in some instances, comparison of secondary method results (e.g. NIR) to those from reference methods.

7.4.2 The aim is for individual laboratories to monitor the performance of their methods and know how they compare to others performing similar analyses. This can give confidence to the laboratory, and its customers, that results are reliable and any deterioration in performance can be detected and then remedied.

7.4.3 The UKGTN reference laboratory takes part in several third-party PT Schemes to ensure that they can monitor their performance against a wide range of other laboratories who test the same types of materials but may not take part in the UKGTN scheme. Schemes currently include:

7.4.3.1

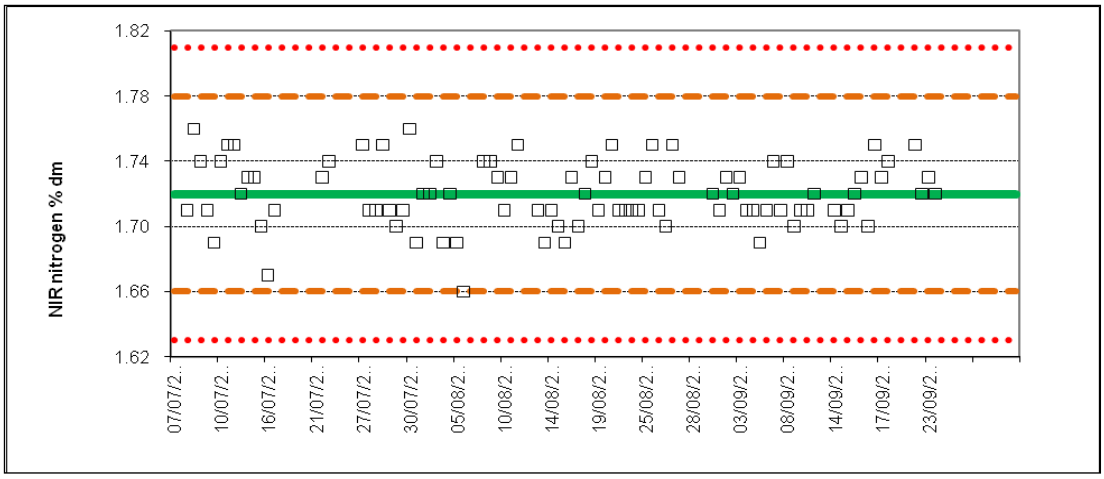
Scheme name	Operator	Commodities and tests signed up for
Foss World Grain Network	Foss DK Ltd.	**Barley** – Oven Moisture, Dumas Nitrogen, Kern SPW, Foss NIR (Moisture, Nitrogen, SPW) **Wheat** – Oven Moisture, Dumas Protein, Kern SPW, Foss NIR (Moisture, Nitrogen, SPW), Falling Number **Rapeseed** – Oven Moisture, Foss NIR (Moisture, Oil) **Rapeseed (via Sharnbrook Grain)** - Oven Moisture, NMR (Moisture, Oil), Foss DA 1650 (Moisture, Oil)
Openfield PT Scheme	Openfield Agriculture Ltd.	**Barley** – Oven Moisture, Dumas Nitrogen, Kern SPW, Foss NIR (Moisture, Nitrogen, SPW), Perten NIR (Moisture, Nitrogen, SPW), Infracont NIR (Moisture, Nitrogen, SPW), Screenings, Admix, Ergot, Germination, Skinned Grains, Broken Grains, Split Grains **Wheat** – Oven Moisture, Dumas Protein, Kern SPW, Foss NIR (Moisture, Protein, SPW), Perten NIR (Moisture, Protein, SPW), Infracont NIR (Moisture, Protein, SPW), Screenings, Admix, Ergot, Falling Number **Rapeseed**– Oven Moisture, Foss NIR (Moisture, Oil), Perten NIR (Moisture, Oil), Infracont NIR (Moisture, Oil), Admix, Immature Seeds, Burnt Seeds, Rancid Seeds, Chitted Seeds **Oats** – Oven Moisture, Dumas Protein, Kern SPW, Foss NIR (Moisture, Protein, SPW), Perten NIR (Moisture, Protein, SPW), Infracont NIR (Moisture, Protein, SPW), Screenings **Beans** – Oven Moisture, Dumas Protein, Foss NIR (Moisture, Protein), Perten NIR (Moisture, Protein), Infracont NIR (Moisture, Protein), Admix, Bruchid %, Stained % **Peas** – Oven Moisture, Admix, Colour
Frontier PT Scheme	Frontier Agriculture Ltd.	**Barley** – Oven Moisture, Dumas Nitrogen, Kern SPW **Wheat** – Oven Moisture, Dumas Protein, Kern SPW **Oats** – Oven Moisture, Dumas Protein, Kern SPW **Beans** – Oven Moisture, Dumas Protein **Rye** - Oven Moisture, Dumas Protein, Kern SPW

7.4.4 Network Members are encouraged to run their own, Internal Quality Control (IQC) checks and plot results on a control chart (particularly during Harvest Intake). This will monitor the day-to-day precision and reliability of the instrument. (See charts below)

7.4.5 A recent UKGTN ring check sample may be useful as an IQC sample as the reference mean value will be accurately known (shown on the UKGTN reports as "Assigned value")

7.4.5.1 This sample should be prepared for use following the AHDB guidelines given in the Online training module GO5-Quality Assurance. https://ahdb.talentlms.com/index

7.4.5.2 Below is an example of an IQC chart for Barley Nitrogen on a Dry Matter Basis. The assigned value is 1.72 % with Warning limits at ± 0.06 % (1.66 % and 1.78 %) and Action limits at ± 0.09 % (1.63 % and 1.81 %)



7.5 Ring Check Sample Preparation and Distribution

7.5.1 Samples are prepared and distributed by the UKGTN reference lab each month.

7.5.1.1 Bulk samples are supplied by Network members and are cleaned (unless selected for the additional tests in which case it will be clearly labelled as uncleaned), blended, split and packed in resealable plastic bags labelled with the sample ID and variety.

7.5.1.2 They are then distributed by courier to Network members and Reference laboratories for analysis.

7.6 Submitting Ring Check Results

7.6.1 The analyses from each member instrument are recorded via the UKGTN portal at https://portalukgrain.org

7.6.2 Each instrument is linked to at least one portal user account. However, each instrument can have as many user accounts as required. Please note that if a user does not log into the portal for 12 months their account will be deleted due to inactivity (following an appropriate warning).

7.6.3 After the closing date for each round, the data submitted is processed by UKGTN and shortly afterwards reports become available on the portal for members to view, save as an electronic copy or print.

7.6.4 There are instructional videos on how to use the portal to submit results, view, save or print reports on the UKGTN website at https://www.ukgrain.org/ and detailed instructions can be found via the portal at https://portalukgrain.org/uploads/ukgtn-portal-instructions.pdf

7.6.5 Sometimes it becomes clear that a member has made a transcription error and switched the data for moisture and protein (for example) or mixed up the samples during testing, not recorded which instrument was used, not recorded an appropriate calibration name or reported a result of zero when a test was not carried out.

7.6.6 If the Technical Administrator becomes aware of potential errors while the round is still open, the member may be contacted and asked to check and amend their data before the round closes. UKGTN does not review all data for every instrument in every round so this check should not be relied upon to spot any errors. It is the member's responsibility to ensure that data is transcribed and reported accurately and completely.

7.6.7 We are unable to accept any amendments to results after the closing date.

7.7 'Spare' Instruments

7.7.1 **The Network no longer owns or operates any 'spare' instruments**. Spares may be available from the instrument suppliers listed in Appendix III, but availability is at their discretion and may be dependent on factors such as number of instruments currently available, network membership status, service contract status, warranty etc.

7.7.2 Availability of spare instruments from the instrument suppliers may be time-limited, subject to supplier T&C's regarding breakdown and repair costs and may require the member to pay for instrument carriage to and from their location using a dedicated door-to-door courier service chosen by the supplier

7.7.3 If you are using a spare provided by one of the instrument manufacturers you will not be able to enter the monthly results into the PT Portal as you only have access to your own instruments via the portal.

7.7.4 In such cases you should enter any Falling Number and Reference or Chondrometer data against your own subscription via the portal as normal. If the spare is a networked instrument, you should then email the NIR results to admin@ukgrain.org and the Technical Administrator will enter them on your behalf.

8. How to read and interpret Ring Check Reports

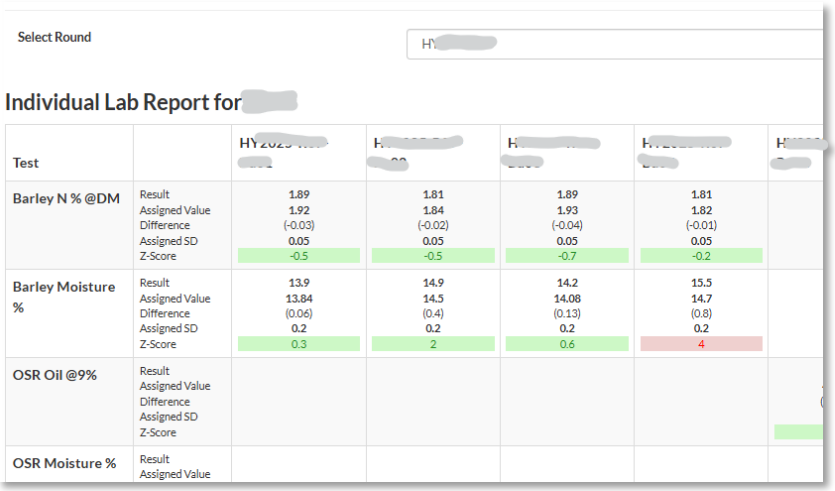
8.1 Once the Ring Check round is closed, and data processing is complete, all members will receive an email from the PT Portal alerting them that the latest set of Ring Check Reports are available to view. This section will outline how to interpret those reports to make the best use of the information that they contain.

8.2 **It is the member's responsibility to read the ring check reports, investigate unusual z-scores and biases, and take any corrective or preventative action which may be required.**

8.3 There are three report types available from the portal, and these are best looked at in the order outlined below. Further details on how to use the portal can be found at https://portalukgrain.org/uploads/ukgtn-portal-instructions.pdf

8.3.1 **The Individual Lab Report** (opened by clicking on 'Subscriptions' and then the 'Report' icon in the 'Actions' column.)

8.3.1.1 This report gives a summary of data for all schemes completed by a single instrument in a single round and its main use is as an 'at a glance' view of all your z scores for the month on a single page. This makes it an ideal report to print out and sign as evidence that you have reviewed your performance in the Ring Check Scheme.



Select Round

Individual Lab Report for

Test						
Barley N % @DM	Result	1.89	1.81	1.89	1.81	
	Assigned Value	1.92	1.84	1.93	1.82	
	Difference	(-0.03)	(-0.02)	(-0.04)	(-0.01)	
	Assigned SD	0.05	0.05	0.05	0.05	
	Z-Score	-0.5	-0.5	-0.7	-0.2	
Barley Moisture %	Result	13.9	14.9	14.2	15.5	
	Assigned Value	13.84	14.5	14.08	14.7	
	Difference	(0.06)	(0.4)	(0.13)	(0.8)	
	Assigned SD	0.2	0.2	0.2	0.2	
	Z-Score	0.3	2	0.6	4	
OSR Oil @9%	Result					
	Assigned Value					
	Difference					
	Assigned SD					
	Z-Score					
OSR Moisture %	Result					
	Assigned Value					

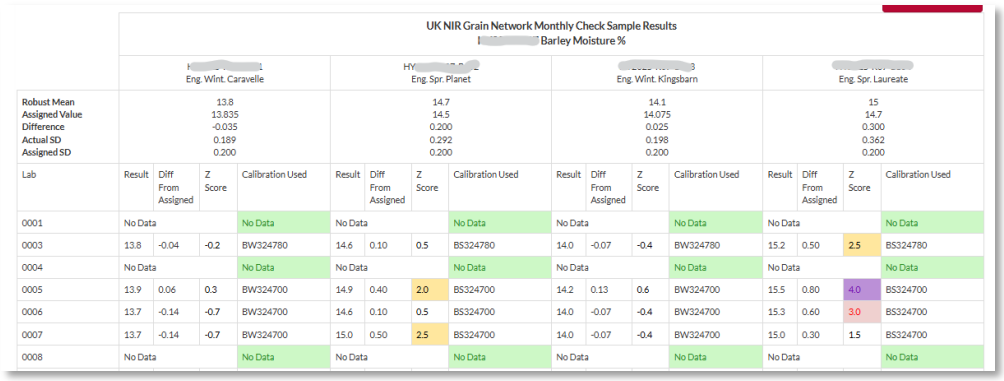
8.3.1.2 For each analyte and sample, it shows the result that you submitted, the assigned value and the difference between the two. It then shows the assigned SD and the z-score that your result generated. Z-scores are colour coded to allow easy interpretation.

Z-score	Interpretation.
Between -2.0 and +2.0	Satisfactory but if results are consistently above or below zero then the instrument may have a bias.
Between -2.1 and -3.0 or +2.1 and +3.0	**Questionable:** Some attention to equipment or procedures may be required.
Between -3.1 and -4.0 or +3.1 and +4.0	**Unsatisfactory:** Examination of equipment or procedures is required.
Below -4.0 or above +4.0	**Statistical Outlier:** Urgent action is required as result very unlikely to be 'correct'

8.3.1.3 A single high z-score amongst mostly acceptable ones may well be due to a “one off” error of some sort and should not cause too much concern. In fact, 1 in 20 ‘normal’ z-scores will statistically fall outside of -2.0 to +2.0 and a simple retest of the sample following review of this report may result in a more satisfactory result.

8.3.2 The Monthly Report (opened by clicking on ‘Report’, Selecting a Scheme, Round and Test and then clicking on ‘Generate Report’)

8.3.2.1 This report gives details of the results from all instruments for a particular analyte in a single round and allows you to see how your results fit into the bigger picture rather than just seeing a z-score in isolation.



UK NIR Grain Network Monthly Check Sample Results
[redacted] Barley Moisture %

	[redacted] Eng. Wint. Caravelle				HY[redacted]2 Eng. Spr. Planet				[redacted]3 Eng. Wint. Kingsbarn				[redacted] Eng. Spr. Laureate			
Robust Mean	13.8				14.7				14.1				15			
Assigned Value	13.835				14.5				14.075				14.7			
Difference	-0.035				0.200				0.025				0.300			
Actual SD	0.189				0.292				0.198				0.362			
Assigned SD	0.200				0.200				0.200				0.200			
Lab	Result	Diff From Assigned	Z Score	Calibration Used	Result	Diff From Assigned	Z Score	Calibration Used	Result	Diff From Assigned	Z Score	Calibration Used	Result	Diff From Assigned	Z Score	Calibration Used
0001	No Data			No Data	No Data			No Data	No Data			No Data	No Data			No Data
0003	13.8	-0.04	-0.2	BW324780	14.6	0.10	0.5	BS324780	14.0	-0.07	-0.4	BW324780	15.2	0.50	2.5	BS324780
0004	No Data			No Data	No Data			No Data	No Data			No Data	No Data			No Data
0005	13.9	0.06	0.3	BW324700	14.9	0.40	2.0	BS324700	14.2	0.13	0.6	BW324700	15.5	0.80	4.0	BS324700
0006	13.7	-0.14	-0.7	BW324700	14.6	0.10	0.5	BS324700	14.0	-0.07	-0.4	BW324700	15.3	0.60	3.0	BS324700
0007	13.7	-0.14	-0.7	BW324700	15.0	0.50	2.5	BS324700	14.0	-0.07	-0.4	BW324700	15.0	0.30	1.5	BS324700
0008	No Data			No Data	No Data			No Data	No Data			No Data	No Data			No Data

8.3.2.2 For each sample, the top of the table shows the Robust Mean of all data submitted, the Assigned Value used for calculating z -scores and the difference between the two. It then shows the actual Standard Deviation of all the data submitted and the assigned Standard Deviation used when calculating z-scores.

8.3.2.3 There are a couple of things to look out for here. If the Robust Mean and the Assigned Value differ significantly on all samples, in the same direction, then there may be a calibration bias affecting the whole population of instruments. On a single sample this could be due to an unusual variety or a sample which was unusually wet or dry or subject to some growing or storage conditions that are not well represented in the calibration set. It could also be due to issues with the Reference Data.

8.3.2.4 If the Actual SD is much higher than the Assigned SD this indicates that the instrument population are not in close agreement with each other. This could be due to calibration variability or, more likely, to a small number of outlier results. Outliers can be caused by instrument issues but are more usually due to data transcription errors.

8.3.2.5 The next section of the table shows the results from each instrument on its own row. Each instrument is identified by its Network Number (shown as ‘Lab’ on this report). Network Numbers are assigned by UKGTN when an instrument joins the network. The link between Network Number and the identity of the instrument owner is confidential and known only to the owner, Network Administrator, UKGTN Ltd. and the appropriate instrument supplier.

8.3.2.6 Scan down the report to find the row(s) for your instruments, then, for each sample, we have Result, Difference from Assigned Value, z-score and Calibration Used. Anything other than a Satisfactory z-score is colour coded using the same colours as the Individual Lab Report.

8.3.2.7 Unsatisfactory or Outlier z-scores should prompt you to launch and record an investigation to find out the root cause and put in place some corrective and preventative actions remembering that the odd Questionable z score may occur by statistical chance so in isolation may not be an issue.

8.3.2.8 The next column is 'Calibration Used'. The instrument suppliers maintain websites which list the most up to date calibrations. These can be found by following the links below.

FOSS	PerkinElmer For the Better	Infracont Instruments

8.3.2.9 The report colour codes this field to indicate whether the 'calibration used' submitted is on the current lists or not. If the code is highlighted in blue, then it is **not** on the list of current codes for this sample type, and you should investigate and record why. **Full Members should always report the calibration codes when they report analyte data.**

8.3.2.10 Common reasons for incorrect codes include:

8.3.2.10.1 Typographical error

BT324500	This code has never existed. It should say BR324500
Br 324500	An extra space has been inserted into the name. It should say BR324500
BR32500	A digit has been missed out. It should say BR324500
Scot Spr 23	The name should be Scottish Spring Barley 23-1.0
23-1.0	The name should be Winter Barley 23-1.0

Please exercise care when entering data and make sure that you type in the calibration name exactly as it is displayed on your instrument.

8.3.2.10.2 Out of date calibrations

BW324401	The current calibration is BW324501
wb22.0	The current Calibration is wb23.3
English Spring Barley 22-1.0	The current Calibration is English Spring Barley 23-1.1

Please connect your instrument to the internet and synchronise it to download the latest calibration version. Contact your instrument supplier if you require further advice.

8.3.2.10.3 Misunderstanding what this field is for

yes Electrum-Winter 23-1.0 Graham 0.5 WHEAT 2023 73.9	None of these entries are calibration codes issued by the instrument manufacturers.

The calibration code field should be used to record the calibration name used when you tested the sample. It should be entered exactly as it is displayed on your instrument to allow the portal text matching software to compare it with the list of current calibrations.

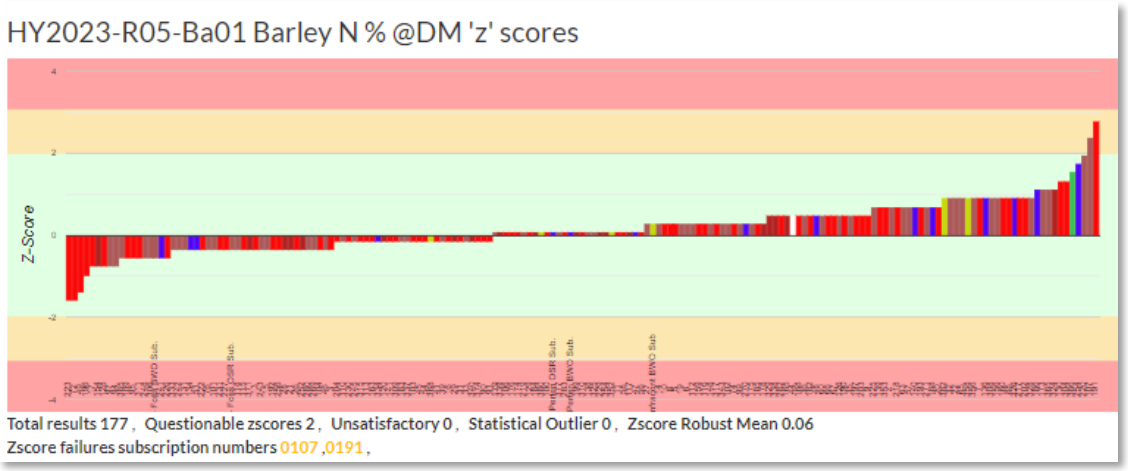
8.3.2.10.4 Current calibration but used on wrong sample.

BR324500	This is the current Scottish Spring calibration, but the sample was English Spring so should have used BS324500
BW324501	This is the current Winter Calibration, but the sample was English Spring so should have used BS324500
ssp 23.3	This is the current Scottish Spring calibration, but the sample is English Spring so should have used English Spring Barley 23-1.1

Make sure that you use the appropriate calibration for each sample, especially when testing Barley samples as there may be more than one Barley calibration installed.

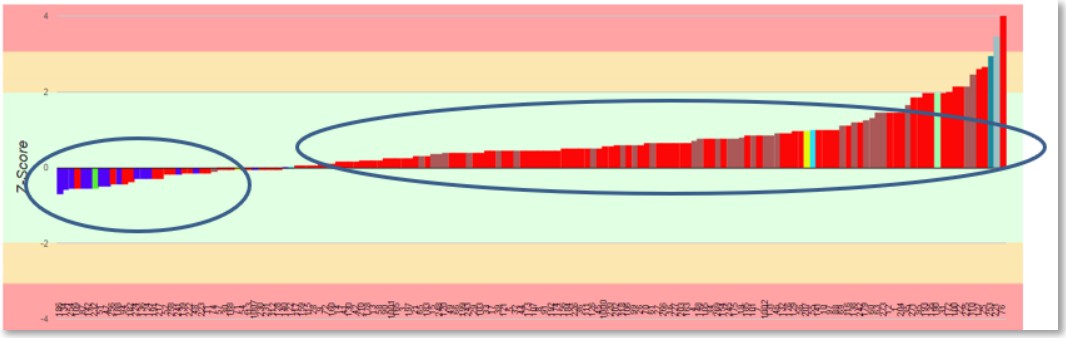
8.3.2.11 If the cell is highlighted in green then you have a Ring Check Only instrument and the calibration code matching applied to Full Member instruments does not apply.

8.3.2.12 The bottom half of the monthly report shows how the z-scores for each sample are distributed. An 'ideal' chart, like the one below, is one which has a gentle 's' shaped distribution with a z-score of zero in the middle of the population and almost all the bars remaining within the green, satisfactory, zone.

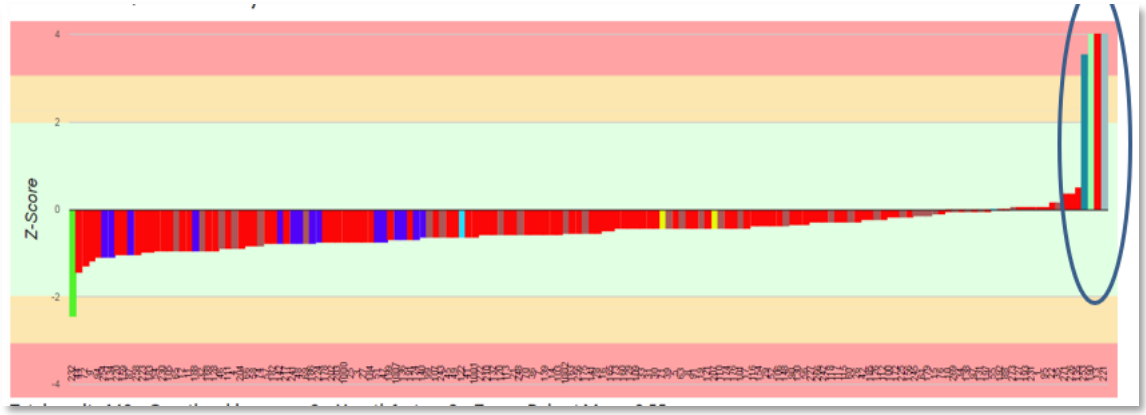


8.3.2.13 The statistics at the bottom of each chart record how many results were submitted and how many of these resulted in Questionable, Unsatisfactory or Outlier z-scores. The z-score robust mean should be as close to zero as possible. The further away from zero it is the more biased the population is vs the assigned value. The chart is colour coded by instrument type so that any instrument type specific biases can be easily seen.

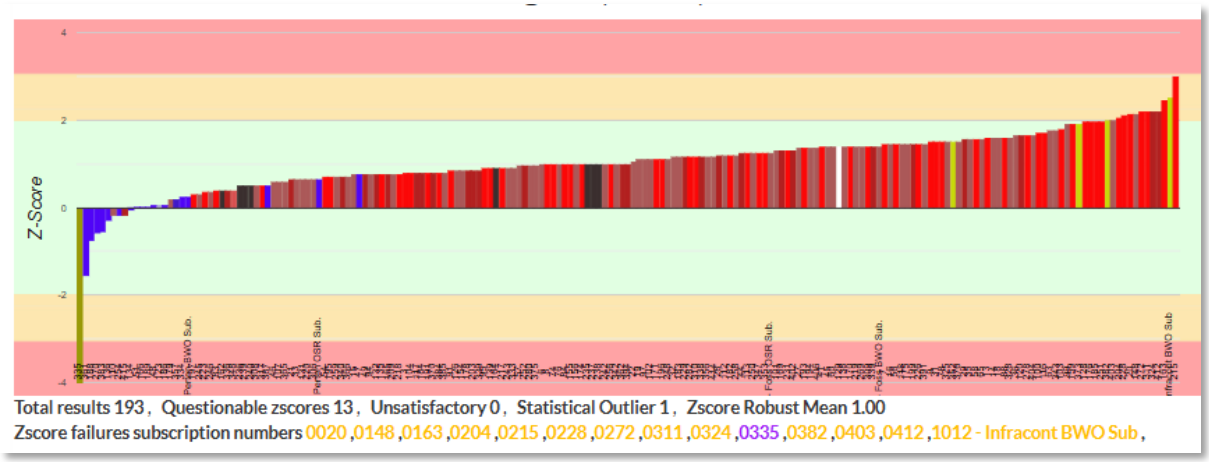
8.3.2.14 Here are a few examples of things to look out for:



8.3.2.14.1 For this sample, all the blue bars are all clustered together – this shows that all the instruments of this type are reading the same as each other but differently to the other instrument types. Although they are all at one end of the distribution this is not a problem here as they all have z-scores close to zero. The red bars are generally shifted to the right with an average z score around 1. Although performance varies on a sample-by-sample basis we would hope that not all the samples in a round showed the same trend as this could indicate calibration bias on this instrument type.



8.3.2.14.2 In this example most instruments, of all types, performed very well but there are a few with extremely high z scores. Only a proper investigation by the user will identify the root cause of the poor z scores. However, likely causes include wrong sample tested, wrong calibration used, data transcription error, operator error or instrument error.



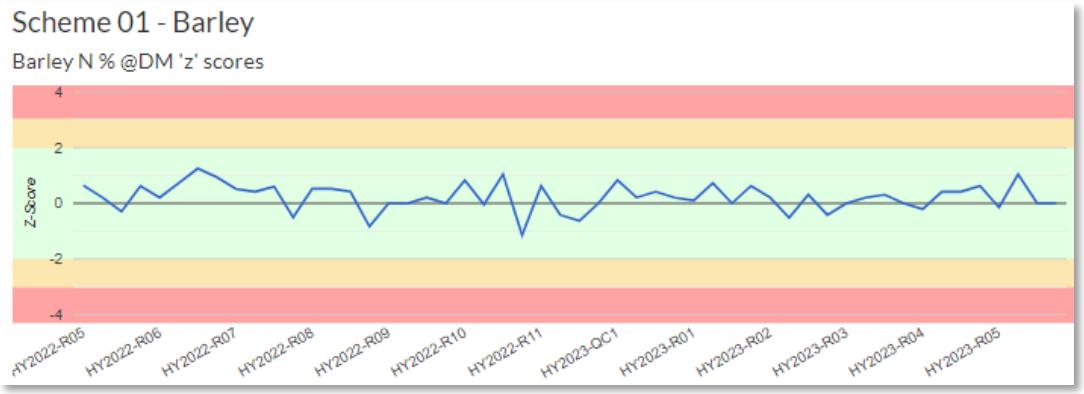
8.3.2.14.3 Here, the whole population of instruments is shifted to one side, and we see a z-score robust mean for Protein of 1.00. There are 13 questionable z-scores but these are not due to individual instrument problems, rather a poor prediction on a sample possibly underrepresented in the calibration set, or a poor assigned value. Only the instrument with the Outlier z-score should be concerned about their individual data.

8.3.2.14.3.1 The network monitors this type of bias and tries to identify, along with the instrument suppliers, if the samples were unusual in any way or whether the same bias is seen on multiple samples and requires a calibration bias to correct.

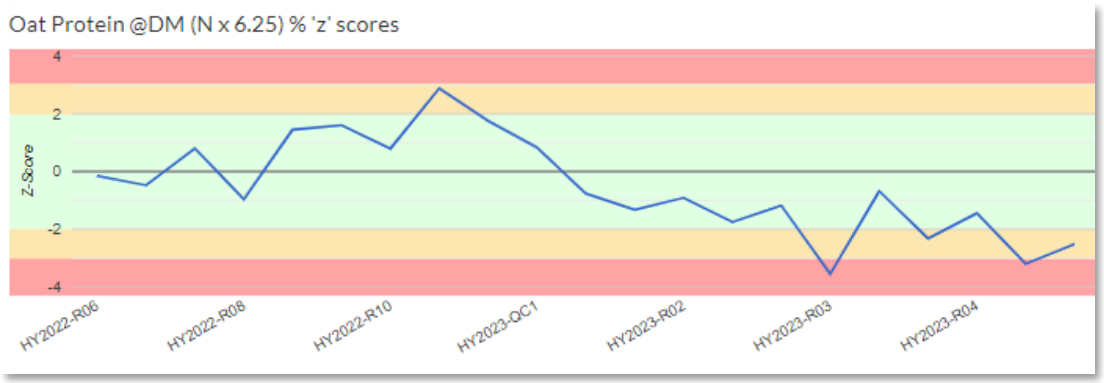
8.3.3 **The Trend Report** (opened by clicking on 'Trends', selecting a test (or all tests), a start month and then a Lab, Subscription or Instrument Type')

8.3.3.1 This report takes data from previous rounds and pulls it together into a single report so that you can monitor trends over time. This is very useful in identifying an instrument bias, which may exist but not be large enough to result in poor z-scores on individual samples.

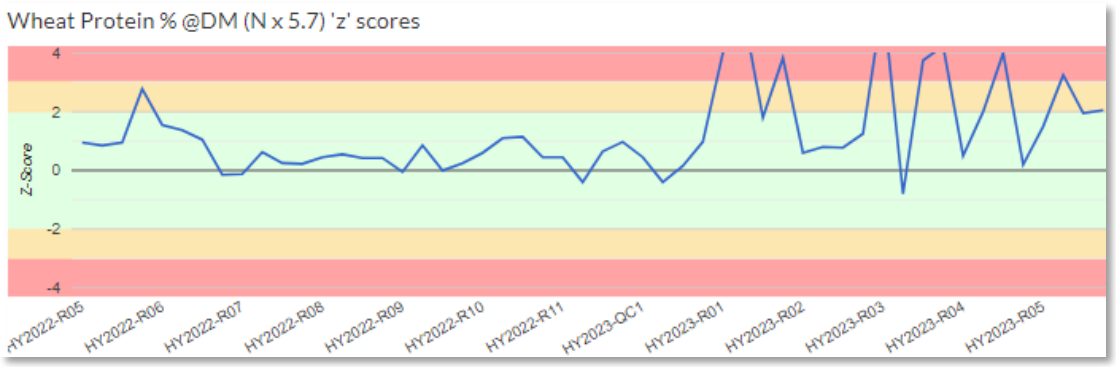
8.3.3.2 An 'Ideal' report would look like the one below with data evenly spread around the central axis and always within the ± 2 'satisfactory' z-score zone. This shows that there is no instrument bias and that the instrument is generating satisfactory data over time.



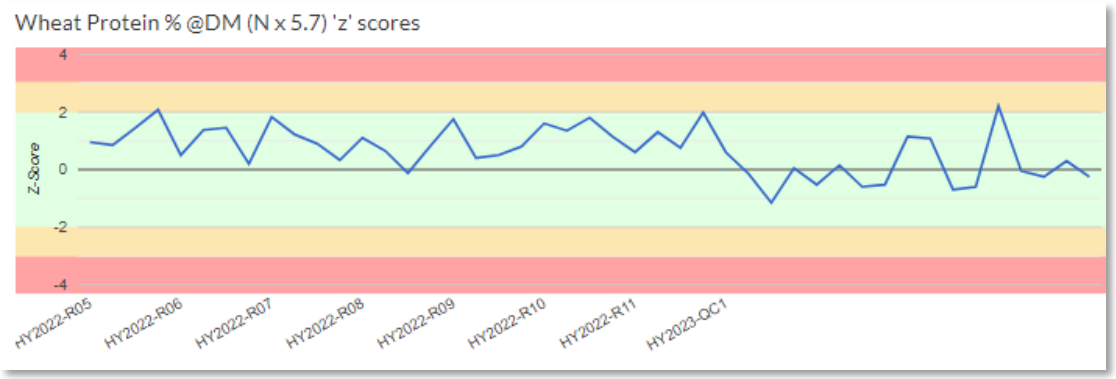
8.3.3.3 Here are a few examples of Trend Reports which are not ideal.



8.3.3.3.1 This example could indicate that a bias was introduced at standardisation and that the instrument is now reading consistently low for this analyte. Further investigation and additional supporting data (re-testing of standardisation samples) could result in an instrument specific bias being authorised by the Network Technical Administrator. However, it is the user's responsibility to monitor bias and inform the Technical Administrator if they believe a bias correction is required as the network does not monitor performance of individual instruments.



8.3.3.3.2 This example shows very variable results for Wheat Protein since standardisation. There is a positive bias but also a lot more unsatisfactory z-scores than should be expected. This may indicate a problem with the instrument and the user should raise this with the instrument supplier.



8.3.3.3.3 This example shows that a positive bias which existed but was not causing z-score failures before standardisation has been corrected for as part of the standardisation process.

8.4 Summary:

8.4.1 You should review the Ring Check Reports each time a new report is issued and record that you have done this so that you can demonstrate this to an auditor if requested.

8.4.2 Following the recommended review order above gives you the best overview of your instrument's performance vs reference and in relation to the other instruments taking part in the scheme.

8.4.3 You should investigate any Questionable, Unsatisfactory or Outlier z-scores to try and find the root cause and put in place appropriate corrective and preventative actions. This investigation should be recorded for review by an auditor if required.

8.4.4 The reports available to you via the PT Portal not only flag when you have a poor z-score but also contain information which may help you to identify the root cause or assess whether the score is significant or not.

8.4.5 As a minimum you should carry out a retest on any samples with poor z scores. If the poor score is due to sample mix up, transcription error, wrong calibration used, 'random chance' etc. then a retest will likely generate a 'better' result and you can sign off your Corrective Action.

8.4.6 If the retest result is still incorrect then you should investigate other potential causes by examining your daily IQC charts, looking for instrument error messages etc.

8.4.7 If you still cannot find a root cause, then you can contact the service department of your instrument supplier for advice. You can also contact the UK Grain Testing Network Technical Administrator for general advice.

Appendix Ia – Reference Methods

The UKGTN use several reference laboratories to generate data to calculate assigned values for the Ring Check and Standardisation samples. The committee insists that these laboratories use the recognised reference methods, as listed below.

Commodity	Analyte	Reference Method
Barley	Moisture / %	ISO 712-1 or CCAT method 08 (oven 130°C for 2 hours). Any samples with moisture content greater than 15% will be analysed using the double drying method.
	Nitrogen / % DM	Dumas; equivalent to the Campden BRI CCAT Method No.19 or ISO 16634-2
	Test Weight / kg/hL	Chondrometer calibrated according to BS EN ISO 7917-2
Wheat	Moisture / %	ISO 712:2009 (oven 130°C for 2 hours). Any samples with moisture content greater than 15% will be analysed using the double drying method.
	Protein / % (N x 5.70) DM	Dumas; equivalent to the Campden BRI CCAT Method No.19 or ISO 16634-2
	Test Weight / kg/hL	Chondrometer calibrated according to BS EN ISO 7917-2
Oilseed Rape	Moisture / %	ISO 665:2000 / BS 4289-3:2000 (oven 103°C for 3 hours)
	Oil / % @ 9% Moisture	BS EN ISO 10565:1998 – NMR and BS EN ISO 659:2009 - Triple solvent extraction.
Oats	Moisture / %	ISO 712-1:2009 (oven 130°C for 2 hours).
	Protein / % (N x 6.25) DM	Dumas; equivalent to the Campden BRI CCAT Method No.19
	Test Weight / kg/hL	Chondrometer calibrated according to BS EN ISO 7917-2:2009
Beans	Moisture / %	ISO 24557:2009 (air-oven method)
	Protein / % 'as is'	Dumas combustion method based upon ISO 16634-2:2016
Erucic	Erucic Acid expressed as % of Total Fatty Acids	GC using ISO 12966-2:2017
Mycotoxins	Deoxynivalenol (DON) ug/kg 'as is'	HPLC or LC-MS/MS methods
	Ochratoxin A (OTA) ug/kg'as is'	HPLC or LC-MS/MS methods
	Zearalenone (ZEA) ug/kg'as is'	HPLC or LC-MS/MS methods
PSY	Predicted Spirit Yield L/MT 'as is'	SWRI Reference Method

Appendix Ib – Recommended Test Methods

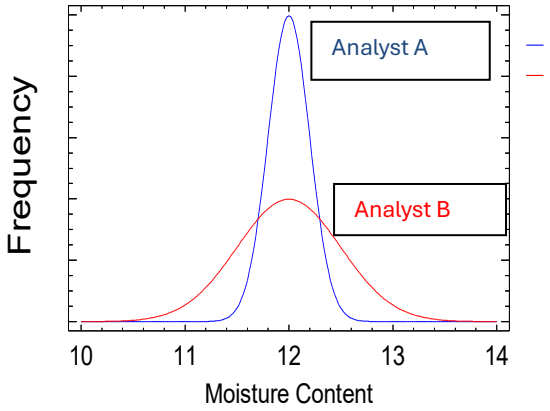
The following tests currently do not use reference laboratories to calculate assigned values for the Ring Check samples. Individual results are compared against the median of all results submitted which should be carried out according to the methods listed below.

Commodity	Analyte	Recommended Test Method
Barley	Admixture / %	Refer to AHDB Training Module G09
	Broken Grain / %	Refer to AHDB Training Module G09
	Skinned Grain/ %	Refer to AHDB Training Module G09
	Split Grain / %	Refer to AHDB Training Module G09
	% Retained on a 2.50 mm sieve	Refer to AHDB Training Module B03
	% Passing through a 2.25 mm sieve	Refer to AHDB Training Module B03
	Germination Capacity / %	Refer to AHDB Training Module B04
Wheat	Falling Number	ICC 107/1, ISO 3093-2004, AACC 56-81B
	Admixture / %	Refer to AHDB Training Module G09
	% Passing through a 2.00 mm sieve	Refer to AHDB Training Module W03
Oilseed Rape	Admixture / %	Refer to AHDB Training Module R02
	Burnt Seed / %	Refer to AHDB Training Module R03
	Chitted Seed / %	Refer to AHDB Training Module R03
	Immature Seed / %	Refer to AHDB Training Module R03
	Rancid Seed / %	Refer to AHDB Training Module R03
Oats	Admixture / %	Refer to AHDB Training Module G09
	% Passing through a 2.00 mm sieve	Refer to AHDB Training Module W03
Beans	Admixture / %	Refer to AHDB Training Module BE02
	Bruchid Damage / %	Refer to AHDB Training Module BE04
	Stained / %	Refer to AHDB Training Module BE03

Appendix II – Statistics

The Normal Distribution and Standard Deviations

Analyst A repeats the same analysis (e.g. an oven moisture determination) on a sample one thousand times and gets a range of results. Analyst B also analyses the same sample one thousand times. We graph the results below:



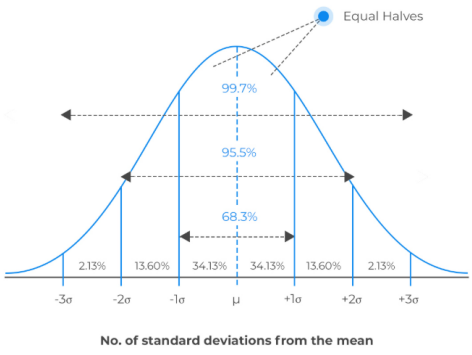
Although both analysts get a **mean** value of 12% moisture, analyst B has a wider **spread** of results. This illustrates the typical bell-shaped curve of a ***normal distribution*** where different methods or operators can produce different levels of variability.

To quantify this spread we use the ***sample standard deviation*** (denoted by the symbol s). This measures how far individual values tend to lie from the mean when you only have results from part of a population.

$$\text{Sample Standard Deviation}, s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$

Where:
n = the number of results
$\bar{x}$ = the mean of the results
x_i = the individual observation
Σ = sum of all $(x_i - \bar{x})^2$ values from 1 to n.

In the graphs above, Analyst A has a standard deviation of 0.2% and Analyst B 0.4% demonstrating greater variability. The areas under a normal curve are given below:



If results follow a normal distribution, approximately:

68.3% of the values will lie within ± 1.0 standard deviation of the mean
95.5% will lie within ± 2.0 standard deviations
99.7% will lie within ± 3.0 standard deviations

Z - Scores

Comparing data from different samples when their means and standard deviations differ/ This becomes much easier if values are transformed so that the mean becomes 0 and the standard deviation becomes 1. This transformation produces a **z-score**, which expresses how far a result lies from the mean in units of standard deviations.

This is done by using the following formula:

$$\text{Standard Score, z} = \frac{x - \bar{x}}{s}$$

Where:
x̄ = the mean of all results
x = the individual observation
s = the sample standard deviation

In the UKGTN Ring Checks:

x̄ becomes the *assigned reference value*

s is the appropriate TASCC *'SD for PT'* from TASCC Appendix 17 **(https://www.agindustries.org.uk/resource/appendix-17-tascc-ahdb-cereals-standards-for-testing.html)**

The Network periodically review historical ring check data, validate the standard deviations used to calculate ring check z-scores and compare the values with those given in the TASCC appendix. The Network aim to use a value equal to or below the TASCC published value.

This approach ensures consistent 'performance goal posts' between rounds rather than allowing the mean and standard deviation of each data set to alter the interpretation.

When data are normally distributed and the NIR mean matches the assigned value, z-scores can be interpreted as follows:

Statistical Probability	Z-score	Interpretation.
95.45%	Between -2.0 and +2.0	**Satisfactory:** but if results are consistently above or below zero then the instrument may have a bias.
4.28 %	Between -2.1 and -3.0 or +2.1 and +3.0	**Questionable:** Some attention to equipment or procedures may be required.
0.26 %	Between -3.1 and -4.0 or +3.1 and +4.0	**Unsatisfactory:** Examination of Equipment or Procedures is required.
0.01 %	Below -4.0 or above +4.0	**Statistical Outlier:** Urgent action is required as result very unlikely to be 'correct'

Repeatability and Reproducibility

It is important to know how accurate and precise a method and a laboratory's results are. Repeatability is a measure of the spread of results within a laboratory and reproducibility the spread between laboratories. Samples may be distributed by organisations in special trials (normally according to ISO protocols) to determine the repeatability and reproducibility of various laboratory methods. The following statistics are often used:

The **repeatability standard deviation** s_r *or* σ_r is generally applied to the results obtained using the *same method* and *same material* under the *same conditions* (same operator, apparatus and laboratory). This is the within laboratory variation.

The **reproducibility standard deviation** s_R applies to the results obtained using the *same method* and *same material* tested in *different laboratories* (different operators, different apparatus and laboratories). This is the total variation and is calculated by combining the between-laboratory variance, the sample/laboratory interaction and the within-laboratory variance.

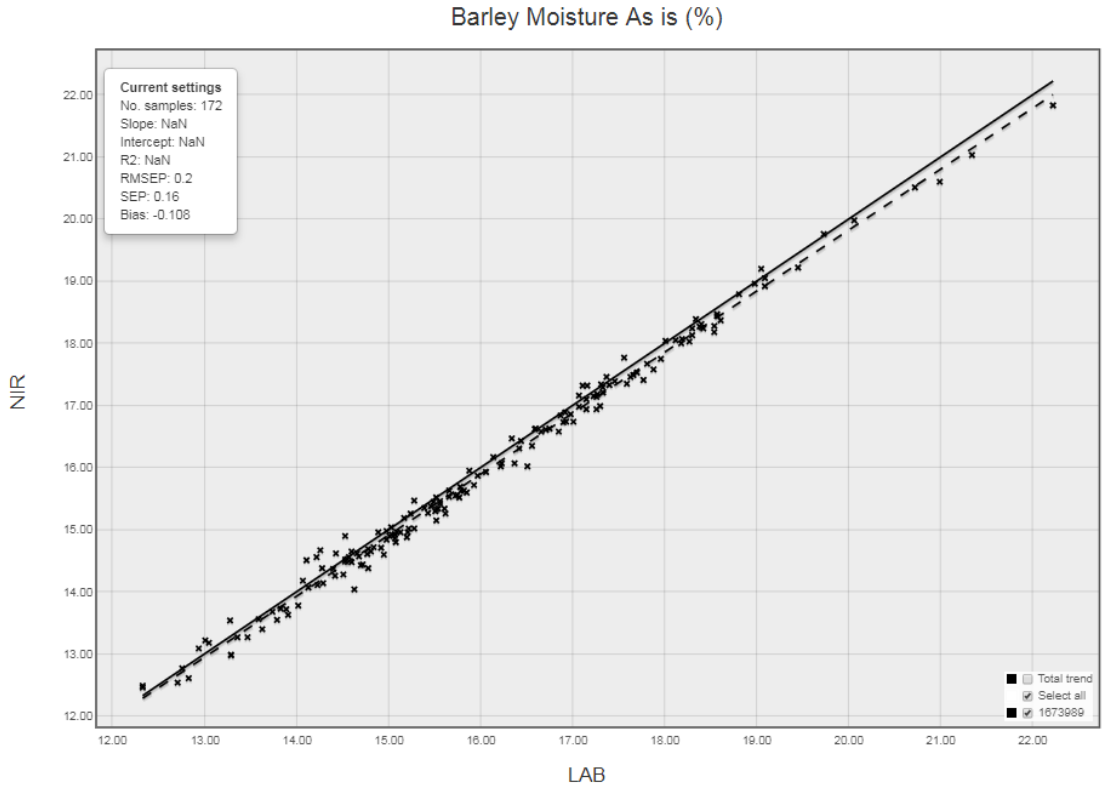
The **repeatability limit** r_{95}. The absolute difference between two independent single test results, obtained with the *same method* on the *same material* in the *same laboratory* by the *same operator* using the *same equipment* within a *short interval of time* shall not be greater than the value of r_{95} in more than 5% of cases.

The **reproducibility limit** R_{95}. The absolute difference between two independent single test results, obtained with the *same method* on *identical test material* in *different laboratories* by *different operators* using *different equipment* shall not be greater than the value of R_{95} in more than 5% of cases.

Typical values for Repeatability and Reproducibility limits for the commodities and analytes that the UKGTN cover can be found in TASCC Appendix 17 **https://www.agindustries.org.uk/resource/appendix-17-tascc-ahdb-cereals-standards-for-testing.html)**

Regression Analysis

When using NIR, the NIR predicted values are compared for the same samples analysed by reference chemistry. When comparing the results, we obtain the typical graphs below.



The Standard Error of Prediction (SEP or SED) is an expression of the bias corrected average difference between predicted and reference values predicted by a regression model when applied to a set of samples not included in the derivation of the model.

The Root Mean Square Error of Prediction (RMSEP or RMSED) is an expression of the average difference between reference values and those predicted by a regression model when applied to a set of samples not included in the derivation of the model. Note – RMSEP includes any bias in the predictions.

The Bias is difference between the mean reference value and the mean value predicted by the NIR model.

The slope of a regression line represents the amount Y increases for unit increase in X.

The median. When data points are arranged in order of magnitude, the median is the central member of the series. There are equal numbers of samples greater and lower than this value.

Typically, when analyses are predicted by NIR, 95% of the predicted values will agree with the reference values to within ± 2 Standard Error of Predictions. Thus, for the graph above, 95% of the moisture results predicted by NIR would agree with the oven moisture values to within ± 0.16%

Reference Analytical Methodology – Accepted Values

All the results from each sample in the ring check are compared with an accepted value to calculate a z-score. This is true of both Reference and NIR Data and data from other sources such as Falling Number, visual analysis and Mycotoxin Test Kits. How the accepted value is calculated varies depending on the grain type, test and amount of reference data available. Three different techniques may be used:

1. Where reference data is not easily available, the assigned value will be based on the median of all test data supplied, after removal of statistical outliers. This technique is used for tests such as Falling Number, Admix, Screenings etc.

2. Where reference data is available, and there are 8 or more reference results after removal of statistical outliers, the assigned value will be calculated as the median of all reference data after removal of the outliers. This technique is used for tests such as Wheat Moisture, Barley Specific Weight etc.

3. Where reference data is available, but there are fewer than 8 reference results after removal of statistical outliers, the assigned value will be calculated as the mean of all data after removal of the outliers. This technique is used for tests such as PSY, Erucic Acid etc.

Appendix III – Contacts

Should you need to contact UKGTN for any reason, please use the information below to identify the best route for your enquiry. If you are an existing member, please state your Network Number when you contact us.

PT Portal: The PT Portal can be found at **https://portalukgrain.org/**. If you experience any difficulties accessing or using the portal, require new users setting up etc. please email portal@ukgrain.org or call Paul Allison on 07999 900 683. Full instructions on how to use the PT Portal can be found at **https://portalukgrain.org/uploads/ukgtn-portal-instructions.pdf** and there are video guides at **https://www.ukgrain.org/portal-user-giudes**

Ring Check Samples: If any samples are missing or damaged on receipt, delivered to the wrong address or held in customs, please email paul.allison@ukgrain.org or call 07999 900 683

Ring Check Reports: Any queries relating to the content of Ring Check Reports should be directed to paul.allison@ukgrain.org or call on 07999 900 683

Invoicing / Payment / Accounts: If you have any questions about our invoices and how to settle them please email accounts@ukgrain.org or call Vic Cameron on 07738 260 550

Instrument Problems: Issues surrounding communication with instruments, spares, servicing, instrument performance, breakdown etc. should be directed to your instrument supplier. Details of the 3 suppliers that have Full Member instruments are below:

	Foss	Perten	Infracont
Email	info@foss.co.uk servicebi@foss.dk	Info@calibrecontrol.com (Calibre Control) applications.perten@perkinelmer.com (Perten)	office@ampcs.co.uk (AMPCS, part of Calibre Scientific) ukgtn@infracont.com (Infracont)
Phone	+44 (0) 1925 287 700	+44 (0) 1925 860 401 (Calibre Control) +46 851 831 480 (Perten)	+44 (0) 1621 843 354 (AMPCS, part of Calibre Scientific) +36 26 631 520 (Infracont)
Web	https://www.fossanalytics.com/en/	www.calibrecontrol.com (Calibre Control) https://contact.perkinelmer.com/perten-food-quality-testing (Perten)	https://www.ampcs.co.uk (AMPCS, part of Calibre Scientific) https://www.infracont.com/en/about-us (Infracont)
Address	**FOSS Britain & Ireland** Unit 15, Whitworth Court Manor Park, Runcorn Cheshire UK WA7 1WA	**Calibre Control International Ltd.** 5-6 Asher Court Lyncastle Way Appleton Thorn Trading Estate Warrington UK WA4 4ST	**Calibre Scientific.** Block 4, Unit 7 Chappelhall Industrial Estate. Airdre Glasgow UK ML6 8QH

For simple bias adjustment requests please contact Vic Cameron on 07738 260 550 or admin@ukgrain.org to see what data we need to action these. Instrument suppliers for networked instruments will **not** apply bias corrections without authorisation from the Technical Administrator.

General Enquiries: For anything not covered above, changes in contact details or membership requirements, subscription rates, volunteering to supply samples, new ideas and other issues, contact the Network Technical Administrator, Vic Cameron on 07738 260 550 or admin@ukgrain.org

Postal Address: We are located at: Unit H1, Castings Way, Leafbridge Business Park, North Hykeham, Lincolnshire. LN6 9WG

Committee Members: The Network Committee comprises of representatives based around the country and in different sectors of the grain industry. Please feel free to contact any of these if you wish to discuss industry or regional issues or other general points. Those marked w, b, r, o and be are contacts for wheat, barley, rapeseed, oats and beans respectively.

Name	Organisation	Tel	Email
Mark Blakemore (r)	Sharnbrook Grain Storage	07802 291171	mark@sharnbrookgrain.com
Sarah Pick	Openfield Agriculture Ltd.	01476 862728	sarah.pick@Openfield.co.uk
Lynn Hannam	RAGT Ltd	01507 342004	lynne.hannam@ragt.com
Roland Fleming (b)	Simpsons Malt	01289 333303	rolandfleming@simpsonsmalt.co.uk
Sharon Millard	Crisp Maltings	07850 708086	sharon.millard@crispmalt.com
Emily Henson	Frontier Agriculture Ltd.	07831 136182	emily.henson@frontierag.co.uk
Helen Appleyard	Niab	01223 342248	helen.appleyard@niab.com
James Ireland	Irelands Farms Ltd.	07967 380120	james@irelandsfarmsltd.com
Matt Platt (b)	Muntons Malt	01449 618323	matt.platt@muntons.com
Karen Ballinger	Camgrain Stores Ltd.	01638 572800	karenballinger@camgrain.co.uk
Will Durrant (b)	Soufflet Bairds Malt	07980 702642	will.durrant@soufflet bairdsmalt.co.uk
Steve Norman (w)	EB Bradshaw & Sons Ltd.	01377 253163	sn@bradshaws-flour.co.uk

The Network website is at www.ukgrain.org. The website is now the main place where details of important information, changes and news will be posted. Members will be informed by e-mail when there are significant updates. Copies of this Members Handbook can be found in the members section of the website. Suggestions of other items that might be included should be sent to the Technical Administrator.

Open forum, regional meetings, training sessions and webinars: These have been held occasionally over the years (typically in Spring or Autumn, before or after the harvest) and have supplied an opportunity for Network members to meet and hear about Network issues and operations as well as training in topics such as instrument operation, standardisation and interpretation of statistics used in ring check reports. The future of these depends very much on members and their needs. A major aim is to provide feedback to the steering committee on the Network operation, to help improve and develop the services provided. If you feel there is a need for a regional meeting or training session covering any aspect of the work that the Network are involved in, please inform the technical administrator and say what topics would be of interest.

Industry Events: The network may from time to time send representatives to various industry events to meet members, seek ideas and feedback and promote the network to potential new members.

Social media: The network maintains a presence on Facebook and LinkedIn where you can follow us to keep up to date with the latest developments.

NOTES